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Anodonta implicata Say

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Since Thomas Say first described *A. implicata* in 1829, there has been much confusion regarding its identity. This was brought about chiefly by a misunderstanding as to what specific characters separate this species from the other members of the Genus *Anodonta*, and by an absence of good ecologic data.

The following description and remarks are based mainly on a rather extensive collection of this species in the Museum of Comparative Zoölogy. I wish to express my thanks to Dr. H. A. Pilsbry of the Academy of Natural Sciences of Philadelphia and to Dr. H. A. Rehder of the United States National Museum for the privilege of studying the specimens of this species in their collections.

Anodonta implicata Say

Anodonta implicata Say 1829, New Harmony [Indiana] Disseminator 2, no. 22, p. 340 (Pond in Danvers, Massachusetts); Simpson 1914, Descriptive Catalogue of the Naiades, Detroit, Michigan, p. 391; Ortmann 1919, Memoirs Carnegie Museum 8, p. 159, pl. 11, fig. 2-3; Clench and Russell 1940, Biological Survey of the Connecticut Watershed, Survey Report no. 4, Concord, New Hampshire, p. 224, pl. 4, fig. 1, 5.

Anodon implicata Gould 1841, Invertebrata of Massachusetts, p. 118, fig. 78; Edition of Binney 1870, p. 180, fig. 481 (both printed by the State of Massachusetts); DeKay 1843, Zoölogy of New York, Albany, New York, Part 5, Mollusca and Crustacea, p. 202.

Anodonta newtonensis Lea 1838, Transactions of the American Philosophical Society 6, p. 79, pl. 21, fig. 66 (Newtown Creek, New Jersey, near Philadelphia; also Schuylkill, at Fair Mount).

Anodonta housatonica Linsley 1845, American Journal of Science, (ser. 1) 48, p. 277 (Housatonic [River] at Corum, Connecticut) [nomen nudum]; Gould 1848, *ibid.*, (2) 6, p. 234, fig. 45.

Description. Shell often large, reaching from 130 to 165 mm., rather solid and heavy for an *Anodonta*. Outline elongate-elliptical to elongate-ovate. Valves quite inflated, somewhat sub-cylindrical. Anterior end regularly rounded; posterior end more acutely rounded, older specimens often becoming sub-truncated. Ventral margin slightly rounded, becoming straight or somewhat arcuate in old specimens. Posterior slope slightly compressed, sometimes elevated and slightly alate at the upper posterior angle. Posterior ridge usually well developed and biangulated. Hinge ligament prominent. Beaks well forward of the center, slightly swollen and moderately convex, their sculpture consisting of four or five wavy recurved ridges. Surface of the shell rather smooth, save for growth lines and occasional plaiting of the periostracum. The latter is usually heavy, yellowish brown or greenish brown, sometimes becoming reddish brown or almost black in old specimens. Young specimens are sometimes greenish and may be obscurely rayed. Hinge edentulous, forming a moderately curved line. Beak cavities rather shallow. Muscle scars distinct, well impressed in old specimens. Shell distinctly thickened along the anterior margin below the pallial line. Nacre dull opalescent, generally pale copper, pinkish, or more rarely white or bluish white, usually with a bluish cast toward the margins. There is a difference in the shape of the shell in the two sexes, but it is sometimes difficult to recognize with certainty. The female is usually more swollen than the male in the middle portion of the disk, which tends to make the lower margin more curved and the shell somewhat shorter and higher than that of the male.

	Length	Height	Width				
large (male)	162	77	66 mm.	Agawam River,	Plymouth,	Mass.	
male	116	54	45	"	"	"	"
female	105	60	50	"	"	"	"

Types. Thomas Say's type of *A. implicata* does not exist, nor, strictly speaking, does his type locality, since there are no ponds in Danvers, Massachusetts today. We hereby select



Plate 16. Fig. 1 and 2. *Anodonta implicata* Say. Neoholotype MCZ No. 176769 from the Agawam River, Plymouth, Massachusetts (reduced from 120 mm.) (photographs by F. P. Orchard). Fig. 3. Glochidia, greatly enlarged (photograph by J. R. Miller).

as neoholotype MCZ no. 176769 from the Agawam River (outlet of Halfway Pond), Plymouth, Massachusetts. Neoparatypes from the same locality. This locality is still relatively close to Say's and is about in the center of the range of the species. Dr. Harald Rehder of the United States National Museum has been unable to locate the holotype of Lea's *Anodonta newtonensis*, therefore we select Lea's paratype USNM no. 86561, Schuylkill [River, Fair Mount] near Philadelphia, [Pennsylvania], as lectotype. The location of Linsley's type of *A. housatonia* is uncertain, but it is probably in the A. A. Gould collection, now in the New York State Museum.

Breeding Season. According to Ortmann (1911, p. 303) all *Anodonta* are bradyctic, or winter breeders, the marsupia filling sometime in summer between July and September. The eggs develop rapidly, and the glochidia are generally fully developed in September or October. However, they are not then discharged, but are usually carried through the winter in the marsupium and are not set free until warmer weather begins, that is in April, May or June of the following year. I have collected gravid females on May 8, 1943, and on June 9, 1946.

Glochidia. The glochidia are typical of the genus *Anodonta*, being rather large, subtriangular, with a spine at the tip of each valve. According to Coker (1921, p. 144) all hooked glochidia generally, though not invariably, attach to the exterior and exposed parts of the fish, the fins and scales. The glochidia of *A. implicata* have been found, by the author, on the gills of the host as well as the fins.

Host. The Alewife, *Pomolobus pseudoharengus* (Wilson)¹, which serves as host for the glochidia of *A. implicata*, ranges from Nova Scotia to North Carolina. "The first alewives appear early in April in the few streams tributary to Massachusetts Bay that they still frequent, but are seldom seen in Maine rivers or in the St. John until late April or early May. Thereafter successive runs follow (the last part of May seeming the

¹ Identified by W. C. Schroeder, Associate Curator of Fishes, Museum of Comparative Zoölogy.

heaviest) until well into June.”² Closely allied to *P. pseudoharengus* is another alewife *Pomolobus aestivalis* (Mitchell), whose range overlaps the former's, but extends farther south. Although this species has not been examined for glochidia, it might possibly serve as a host to *A. implicata*.

Distribution. Simpson (1914, p. 391) gives the range of this species as “St. Lawrence-drainage north to Lake Winnipeg; south in streams flowing into the Atlantic to Virginia.” It is certain that Simpson did not understand this species. So far as known, it ranges from New Brunswick and Nova Scotia south to Virginia, being restricted to ponds and streams near the coast that are frequented by the alewife.

Ecology. Although often found in relative abundance in ponds, this species seems to prefer a stream environment, and it is from a relatively swift stream that the largest examples have been taken. It is generally found on a sand or gravel bottom, rarely in mud.

Records. NOVA SCOTIA: Grand Lake, Halifax Co. (MCZ). NEW BRUNSWICK: Grand Lake, Queens Co. (MCZ). MAINE: Eastport; St. Georges River, Warren Village; Damariscotta Pond, Lincoln Co.; Portland (all MCZ). MASSACHUSETTS: Merrimac River, Haverhill; Lynn; Horn Pond, Woburn; Upper Mystic Pond, Medford; Fresh Pond, Cambridge; Whitman's Pond, Weymouth; Weir River, Hingham; Agawam River, Plymouth; Snipatuit Pond, Rochester; Silver Lake, Kingston; Redbrook, Bourne; Megansett; Onset; Harwich (all MCZ). RHODE ISLAND: Cunliff Pond, Providence; Warwick Pond, Warwick (both MCZ). CONNECTICUT: Connecticut River (ANSP); Housatonic River, Corum (Linsley as *A. housatonica*). NEW YORK: Troy (MCZ). NEW JERSEY: Millstone River, Kingston; Outlet of Roosevelt Lake, Metuchen (both MCZ). PENNSYLVANIA: Schuylkill River, near Philadelphia (USNM); Delaware River, Torresdale (ANSP). DISTRICT OF COLUMBIA: Potomac River (USNM).

² Bigelow, H. B., 1925, U. S. Bureau of Fisheries 40, pt. 1, p. 109.



Plate 17. Distributional pattern of *Anodonta implicata* Say in the Northern Atlantic States. Since the plate was prepared an additional record of this species was received from the Potomac River, District of Columbia, which extends the range about one hundred miles farther south. (Map drawn by R.D. Turner)

Remarks. Since the original description of this species was based on an immature specimen (measuring 3.5 by 1.5 inches) and was not figured, it has often been confused with other species of *Anodonta*. Nevertheless, traditionally this is the species generally accepted as representing Say's description and to avoid confusion in the future we have selected a neoholotype (see under *Types*) pl. 16, fig. 1-2.

The most reliable and constant feature in identifying adults of this species is the pronounced thickening of the anterior margin below the pallial line. This is not always pronounced in young specimens but may still be detected. In addition, the dark and usually yellowish or brownish, rayless periostracum and the pale copper or salmon color of the nacre will ordinarily serve to distinguish this species from any other *Anodonta* in eastern North America.

This species has never been found in any pond or stream which is not frequented by the alewife. During the last century *A. implicata* was very abundant in Fresh Pond, Cambridge, Massachusetts; but in recent times, since the outlet has been closed, and the alewife no longer frequents the pond, *A. implicata* has become extinct, and today *A. cataracta* is the only *Anodonta* to be found at this locality. At one time *A. implicata* must have been found in many more localities than it is today, but the alewife has become more and more restricted locally in its distribution because of damming and stream pollution, with the result that *A. implicata* also has become extinct over portions of its range.

As has been mentioned, Simpson (1914, p. 391) seems not to have understood this species. Ortmann (1919, p. 161) on the other hand, even with but little material, has described *A. implicata* well, and has listed several records from the extreme coastal region of Pennsylvania, thus indicating he had considerable knowledge of its distribution.

F. C. Baker (1942, p. 75) has erroneously reported this species from several ponds in Carroll Co., New Hampshire, claiming that *A. implicata* and *A. cataracta* are very variable and often difficult to separate. He bases his differences on the beak sculpture and coloration both of which are at best variable characters. He also claims that the periostracum of *A. implicata* is often a vivid green near the posterior end. Baker's speci-

mens were certainly only off-colored *A. cataracta*. In addition he has reported *A. implicata* from Oneida Lake, New York (1916, p. 253, fig. 41, no. 2). Here again, this is another species of *Anodonta*. The figured specimen is not *A. implicata* and the locality, as well, is outside of the known range of the alewife.

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